Note:

- *All-water systems are more space efficient*
  - In renovation projects, the space can be limited and making the all-water systems better suited.
- *All-air systems utilize 'free cooling' more efficiently*
  - The utilization of 'free cooling' (cooling from the surroundings) in all-air systems do not require any additional equipment. Whereas all-air systems, in most cases, do.

About DREEAM

DREEAM (Demonstration of an integrated Renovation approach for Energy Efficiency At the Multi building scale) aims to show that renovating at a larger scale opens the opportunity for better integration of renewable energy and is generally more cost-effective. The project demonstrates a multi-building and single owner renovation approach that can achieve a 75% reduction of total energy demand.

The DREEAM approach is implemented on pilot sites in the UK, Germany and Italy. These demonstration sites are to validate the DREEAM method in different climate, cultural and institutional configurations.

dreeam
scaling energy renovation

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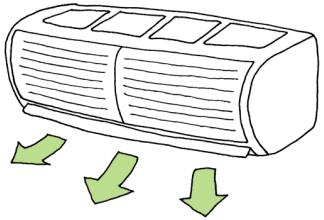
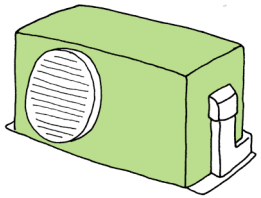
COOLING SYSTEMS





Our cooling needs are increasing

With the rising temperatures, cooling our homes are becoming a greater issue than ever before. Not only are our cities experiencing higher temperatures each year but in less than a generation, air-conditioning has allowed life on the edge of the desert to become far more comfortable.

By the year 2020 the number of air coolers and conditioners is thought to have doubled. Let us plan for a sustainable future by using efficient and renewable technologies.

Buildings may be supplied with cooling from a great variety of sources e.g. district cooling, free-cooling or using refrigerating machines.

Traditional cooling systems

To maintain the indoor temperature below some a predetermined maximum (cooling requirement) surplus must to be removed. To put simply, the cooling requirement is the same as its heat surplus. This is most commonly achieved using one of the following traditional systems:

All-air cooling systems

It can be both difficult and expensive to install an all-air cooling system in an existing building as it may require the replacement of the ventilation duct system. For this system, the rate of airflow is determined by the cooling requirements of the building.

All-water cooling systems

The all-water system supplies cooling from the water to the individual rooms using the ventilation system. They are prevalent in renovation projects as there is usually space in the ceiling for the installation of the water pipes.

Combined systems

All-air and all-water systems can be combined in many ways. One reason for doing so is in cases where the all-air cooling system alone is uncapable of supplying enough cooling. Another being the use of the different systems is parts of a building (e.g. one new and one older).

To generally say that one type of cooling systems should be chosen or not is close to impossible. In most cases, a range of systems could work satisfactory from a technical viewpoint. Thus, the general decisive factor will be the initial cost as well as the cost of running the system.

STATE OF THE ART

Surface Based Cooling System TRL 7*

The surface-based cooling system operates using ceiling, floor or wall panels with chilled surfaces. The system can fill two functions in one using hot water to heat in the winter.

In renovations, it can be problematic to integrate floor heating/cooling into the floor as it may increase the floor level or pose a problem to the load-bearing structures. Thereby, the use of special surface structures enables this without the need for thorough intervention. They range from wet (e.g. screed or plaster) to dry to thin-film systems.

Adsorption Cooling TRL 5

Adsorption refrigerators adsorb the cooling water on a solid sorbent like silica gel or zeolite during the disposal of latent heat on the surface. In this specific technique, a metal-organic framework (MOF) has been developed to be well suited to adsorb water vapour, which has previously been lacking. With the MOF, water vapour absorption increase from 0,4 to 1,4, resulting in a refrigerant capacity three times greater compared to standard chillers.

Green refrigerants TRL 5

The green refrigerants have been around for over a century. But until recently, it has mainly been used within the field of food production and storage. The technological evolution and innovation have led to the implementation of green refrigerants within residential and commercial buildings.

Because of their non-global warming potential, they are said to be a future-oriented technical solution. The natural refrigerants ammonia, CO_2 and more are well proven and economically significant.

Ground Coupled Solid Desiccant Cooling TRL 5

The desiccant cooling systems use water, in direct contact with air, as a refrigerant in an open cycle system. The cooling cycle employs a combination of evaporative cooling and air dehumidification using a desiccant (e.g. a hygroscopic material — a material that can absorb or adsorb water from its surroundings). For this use, liquid or solid materials can be utilized.

This method of cooling utilizes a combination of ground-coupled fluid systems and solid desiccants. In the first stage, the supply air is dried using a solid desiccant wheel, and in the second, it is sensibly cooled by a ground-coupled fluid loop. The use of this technique can result in up to 43% energy savings and increase energy efficiency.

Liquid Desiccant Cooling TRL 5

The liquid desiccant cooling is a reasonably new technology that uses liquid water-lithium chloride solution as sorption material. Advantages to using this technique include higher air dehumidification at the same driving temperature range as solid desiccant cooling systems and the possibility of high energy storage. The application of this technique is a promising option for the increasing exploitation of solar thermal systems for air cooling.

**TRL = Technology Readiness Level, a scale from 1-9 to assess the maturity level of a technology. 1 is the lowest and 9 is the highest.*